

WE CLAIM:

1. A hay bale processor 10 comprising container means 14 for receiving a bale of hay 156, 157 to be cut in fibers, a rotor 28 secured below said container means, said rotor having a plurality of cutting blades 35 disposed about its periphery in space-part parallel relationship, said rotor being aligned with a grill 26 in a bottom wall 23 of said container means and said grill having spaced-apart, parallel, slot openings 27 defining an average fiber cut length therebetween, said blades being aligned with respective ones of said slot openings and projecting therethrough to contact a bottom face 159 of a bale 160 of hay displaced over said grill by bale displacement means 140 and 240 associated with said container means whereby to cut hay from said bottom face, said fibers being discharged through said slots and into discharge conveying means 18, said rotor having a drivable shaft 29 secured to a displaceable suspension mechanism 45 to displace said rotor and consequently said blades of said rotor above said grill a variable distance depending on the resistive load applied to said blades of said rotor when a bale of hay is displaced over said grill, electric motor means 66, 67 coupled to said drivable shaft for rotating same, said displaceable suspension mechanism 45 having pressure biasing means 50 and 280 having a predetermined biasing pressure value, said cutting knives being displaced to retract within said slots when said predetermined biasing pressure value is exceeded by the load on said cutting blades of said rotor whereby said electric motor means maintains a substantially constant drive torque on said rotor drivable shaft and a substantially constant speed of rotation of said rotor.
2. A hay bale processor as claimed in claim 1 wherein said pressure biasing means 50 is a pressure cylinder producing a substantially constant biasing force on said drivable shaft 29 in the direction of said grill.
3. A hay bale processor as claimed in claim 2 wherein said pressure cylinder 50 is an air pressure cylinder.
4. A hay bale processor as claimed in claim 3 wherein said displaceable suspension mechanism 45 comprises a pair of pivotal arms 46, 46' each having a fixed pivot end 48, said drivable shaft 29 being supported adjacent opposed ends of said drivable shaft by a respective one of said pivotal arms, said air cylinder 50 having a piston rod 51 with a piston rod end 52 thereof secured to one of said pivotal arms 46

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and applying said substantially constant upward biasing force on said one of said pivotal arms.

5. A hay bale processor as claimed in claim 4 wherein a driven pulley 65 is secured to an extension end of one of said opposed ends of said drivable shaft extending through its associated pivotal arm 46, said electric motor means being an electric motor 66 having a drive shaft 69, a drive pulley 68 secured to said drive shaft, a drive belt 70 about said driven pulley and drive pulley to impact axial rotation to said driven pulley, and automatically adjustable tension means 72 to maintain said drive belt taut when said driven shaft is displaced when said predetermined biasing pressure value is exceeded by the load on said cutting blades.

6. A hay bale processor as claimed in claim 5 wherein said driven pulley 65 is a double sheave pulley, there being two of said electric motors 66, 67, each motor having an associated one of said belt 70, 71 trained about an associated one of said double sheaves 65, said automatically adjustable tension means being constituted by a floating pulley 72, 73 which is spring biased against a portion of said drive belt 70, 71 of each motor and between said double sheave pulley and drive pulley.

7. A hay bale processor as claimed in claim 4 wherein the other pivotal arm 46' is provided with a piston 53 secured to a free end 55 thereof to remove vibration and to stabilize said drivable shaft 29 of said rotor.

8. A hay bale processor as claimed in claim 4 wherein one of said pivotal arms 46, 46' is provided with adjustable arresting means 57, 58, 59 to limit the displacement of said pair of pivotal arms to position said cutting blades from a retracted position below said slot openings of said grill and a maximum working position wherein said blades project above said slot openings a maximum distance.

9. A hay bale processor as claimed in claim 8 wherein said adjustable arresting means is constituted by a pair of abutment members 58, 59 positioned spaced from one another and disposed on opposed sides of a free end portion of said one of said pivotal arms 46, 46', at least one of said abutment members 59 having an adjustable abutment face 62' disposed to define said maximum distance.

10. A hay bale processor as claimed in claim 3 wherein said spaced-apart slot openings 27 are elongated rectangular slot openings, said openings having adjustable means 90 to vary the width of each said slot simultaneously.

11. A hay bale processor as claimed in claim 1 wherein said adjustable means 90 is provided by at least one displaceable plate 85 having elongated rectangular slot openings 27 therein which are spaced apart a predetermined distance and defining obstructing wall sections between said slot openings, said displaceable plate 85 being retained in frictional contact under uppermost-like slot openings, said displaceable plate being displaceable to register its slot openings 27 with said uppermost-like slot openings 27' or to obstruct a portion of said uppermost slot openings by said obstructing wall sections whereby to adjust the width of said slots and thereby said average fiber cut length.

12. A hay bale processor as claimed in claim 1 wherein said grill is constituted by a rectangular opening 24 in said bottom wall 23, there being provided two of said displaceable plates 85, 87, said plates being rectangular plates held under said rectangular opening and disposed in frictional contact with one another and with a bottom face 88 of said bottom wall 23 of said container means, a displaceable linkage 90 secured to said displaceable plates to displace both said plates with respect to one another whereby to vary the width of each said slots simultaneously.

13. A hay bale processor as claimed in claim 12 wherein said displaceable linkage 90 comprises an actuating arm 91 secured adjacent one end to a stationary pivot 93, a pair of link arms 94, 95 each secured to a respective one of a pivot connection 96, 97 on said actuating arm and disposed on opposed sides of said stationary pivot, said pair of link arms 94, 95 being secured at their other end to a respective one of said two displaceable plates, and a lever 98 secured at the other end of said actuating arm to displace said actuating arm a limited distance about said stationary pivot.

14. A hay bale processor as claimed in claim 13 wherein said lever 98 extends through a slot 99 provided in said bottom wall 23, said slot defining between opposed ends thereof said limited distance.

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15. A hay bale processor as claimed in claim 14 wherein said lever has an engageable end 100 associated with a grid 101 defining a range of said average fiber cut lengths to permit a user person to select a desired average fiber cut length.

16. A hay bale processor as claimed in claim 4 wherein said pressure cylinder 50 is secured to a pressurized air reservoir 80, a compressor 83 to supply compressed air to said reservoir, a pressure regulator 81 to adjust the air pressure in said reservoir, said pressure regulator 81 adjusting said predetermined pressure value on said pivotal arm 46 and drivable shaft supported thereby dependent on the rating of said electric motor means 66, 67 to maintain said substantially constant drive torque.

17. A hay bale processor as claimed in claim 4 wherein said rotor drivable shaft 29 is provided with a plurality of blade support discs 30 secured in equidistantly spaced relationship along said drivable shaft, said discs 30 having blade attachment shoulders 32, each shoulder having a pair of spaced holes 33 to receive fasteners to secure a cutting blade 35 thereto, said blades each having at least one cutting edge 36 angulated to an apex 37 thereof, said pair of spaced holes providing for said blade to be attached to said attachment shoulders with said apex lying substantially on a diametrical axis 39 of said support disc, and a further hole 33' disposed below a trailing one of said pair of spaced holes to secure said blades 36' slanted rearwardly of said diametrical axis.

18. A hay bale processor as claimed in claim 1 wherein said container means is a circular drum 14 supported elevated on a support frame, said drum having a cylindrical wall 16 rotatable over a top wall of said support frame and which constitutes said bottom wall of said container means, support guide means 105 maintaining said cylindrical wall 16 in a constant peripheral vertical guide plane, said drum being rotated by an endless belt 110 trained about belt engagement means 111 secured about a lower portion of said cylindrical wall 16 and a drive sheave 113.

19. A hay bale processor as claimed in claim 18 wherein said cylindrical wall has at least a wall portion thereof being a hinged wall portion 170 for access to the interior of said circular drum 14.

20. A hay bale processor as claimed in claim 18 wherein said top wall 15 of said support frame 12 is a rectangular top wall, said top wall being hinged to said frame, and

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a piston 21 actuatable to hinge said top wall and said circular drum upwardly on a hinge connection 20 to provide access below said top wall and to said grill.

21. A hay bale processor as claimed in claim 18 wherein said drive sheave 113 is a gear box drive sheave driven by a variable speed drive.

22. A hay bale processor as claimed in claim 21 wherein said variable speed drive is constituted by a variable drive sheave 116, a variable tension drive belt 117 trained about said variable drive sheave and a drivable sheave 115 of said gear box, and drive belt tensioning means 118, 120 to vary the circumference of said variable drive sheave and the speed of rotation of said drivable sheave of said gear box.

23. A hay bale processor as claimed in claim 22 wherein said drive belt tensioning means is constituted by at least one displaceable sheave 118 biased against said variable tension drive belt 117 by a linkage 120, said linkage 120 being actuatable to displace said displaceable sheave by a control arm 121 engageable at one of two or more arm engaging positions 122, each said arm engaging position applying a different tension on said drive belt to cause said gear box drive sheave to rotate at a different speed whereby said cylindrical side wall 16 of said drum 14 may be rotated at different speeds.

24. A hay bale processor as claimed in claim 23 wherein said variable drive sheave 116 is driven by said electric motor means 66.

25. A hay bale processor as claimed in claim 24 wherein said electric motor means 66 is coupled to an auger screw drive shaft 133 located in a discharge trough under said rotor and constituting said discharge conveying means, said variable drive sheave 116 being secured to a free end of said auger screw drive shaft 33.

26. A hay bale processor as claimed in claim 4 wherein there is further provided arresting means to limit the displacement of said pair of pivotal arms to position said cutting blades from a retracted position below said slot openings of said grill and a maximum working position wherein said blades project above said slot openings a maximum distance, said arresting means being constituted by a guide slot 67 in a side wall 12 of a support framework 11 under said container means 14 and through which extends said drivable shaft of said rotor.

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27. A hay bale processor as claimed in claim 18 wherein said cylindrical wall 16 is provided on an inner wall surface thereof with two or more of said bale displacement means 140 for engaging a bale of hay 156, 157 and displacing said bale over said grill 26.

28. A hay bale processor as claimed in claim 27 wherein said bale displacement means is constituted by vertically hinged bale engaging fins 140 secured vertically to said inner wall surface 16' by hinge means 141, 142, said bale engaging fins each having a sloped outer edge 144 sloping outwardly and inwards in said tub from a top end to a bottom end, said fins being displaceable towards said inner wall surface 16' on one side of said hinge means when displaced by a bale of hay when inserted in said tub and engaging said bale of hay by stopper means 147 which arrest said fins from displacement against an opposed side of said hinge, said opposed sides trailing the direction of rotation 146 of said tub.

29. A hay bale processor as claimed in claim 28 wherein said stopper means 147 is an angulated reinforcing plate secured to each said fins at a lower wide end portion thereof, said reinforcing plate 147 abutting said inner wall surface 16' on said opposed side of said hinge means.

30. A hay bale processor as claimed in claim 28 wherein said bale engaging fins are provided with attachment means 149 to provide for attachment of fin extension plates 150.

31. A hay bale processor as claimed in claim 18 wherein said cylindrical wall is provided with sighting windows 151 to view the interior of said tub.

32. A hay bale processor as claimed in claim 18 wherein said bottom wall of said tub is provided with at least one arcuate guide rib 155 projecting upwardly from a top surface of said bottom wall 23, said arcuate guide rib 155 being disposed upstream of said grill whereby to shift said bale 160 being displaced over said grill to prevent the formation of cut-out channels 158 in said lower surface 159 of said bale by said cutting blades.

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33. A hay bale processor as claimed in claim 32 wherein there are two or more of said arcuate guide ribs 155 disposed spaced-apart in substantially parallel relationship, each rib having a top edge 160 sloping upwardly from a front end 161 to a rear end 162 thereof, said rear end 162 being disposed adjacent said grill.

34. A hay bale processor as claimed in claim 1 wherein said bale of hay is a circular bale of dry hay.

35. A hay bale processor as claimed in claim 1 in combination an animal feed mixer 180, said discharge conveying means having a discharge port, said discharge port having a coupling flange 181 to removably secure a connecting conduit 182 thereto and to a fiber feeding inlet port 183 of said animal feed mixer for mixing said fibers of average cut length with other animal feed products 186.